Date: February 20, 2007

To: Members, Advisory Committee on Measuring Innovation in the 21st Century

From: Carl J. Schramm, Chairman

Secretary Gutierrez has asked us to recommend "new and improved statistics" that can improve our understanding of innovation. Between now and the time our final report is issued later this year, we will be expected to recommend ways to measure innovation that can illuminate how it occurs in different sectors, how it is diffused across the economy, and what its impact is on growth and productivity.

This Advisory Committee could not be convened at a more opportune time. The American economy, marked by increasingly rapid technological change and new and more innovative firms, has fundamentally changed and moved toward a more entrepreneurial form of capitalism. At the same time, our nation's largest corporations are experiencing significant gains in productivity, reflecting a renewed importance of innovation in more established firms. Yet our data and measurement methods have failed to adapt. Too often, they present an inadequate picture of the U.S. economy, failing to fully capture, for instance, the fast-growing and highly entrepreneurial service sector.

Data collection and measurement may appear to be mundane, the province of economists and statisticians, and decidedly less inspiring than lofty talk of innovation and discovery. But measuring is vitally important if we are to understand how new products, services, and processes influence the workings of our economy. Without accurate information and a clear picture of the functioning

of the economy, policymakers, investors, executives, managers, consumers, and other governments will make uninformed and potentially harmful decisions. The necessity of identifying—and replicating—what works in America's innovation process has never been more important to our nation's long-term economic prosperity, and our place in the global economy.

Our nation's own economic history underscores the importance of sound data. Our current system of national accounts originated in the nadir of the Great Depression, when policymakers were grasping for accurate information on the state of the economy. After economists testifying before Congress in 1931 were unable to provide data on the economy for any period later than 1929, the Department of Commerce and the National Bureau of Economic Research began work on improved data collection.

Now, in the first decade of the 21st century, our committee bears the responsibility to build on the Commerce Department's past successes and to find the best way to measure the advances that are so crucial to the economy of this new era.

But what is innovation? Economies do not grow, and living standards do not improve, without it. Innovation is, in Joseph Schumpeter's phrase, the "fundamental impulse" that keeps economies in motion. Our understanding of the phenomenon, however, remains incomplete. Business researchers have provided us with numerous theoretical definitions of innovation based on case studies. And while it is true that, as Friedrich Hayek observed, "without a theory the facts are silent," case studies will not suffice. We must have accurate and complete statistical series in hand to build an analytic theory of how and why groundbreaking economic change occurs. This committee must focus on how we *quantify* innovation, not simply define or discuss it.

Fortunately, our effort does not begin from scratch. A large body of economic research exists on measuring innovation and its contribution to growth and productivity. Most recently, eminent researchers, including the Committee's own Dale Jorgenson, have made important advances in our understanding in this area. As noted by Professor Jorgenson in a recent letter to his academic colleagues on this committee, we have relatively accurate measures of aggregate innovation, defined as growth of output per unit of input beyond labor and capital investment, and known by an unwieldy bit of economic jargon as "total factor productivity," or TFP. This broad measure captures technological changes and accounts for a substantial portion of economic growth.

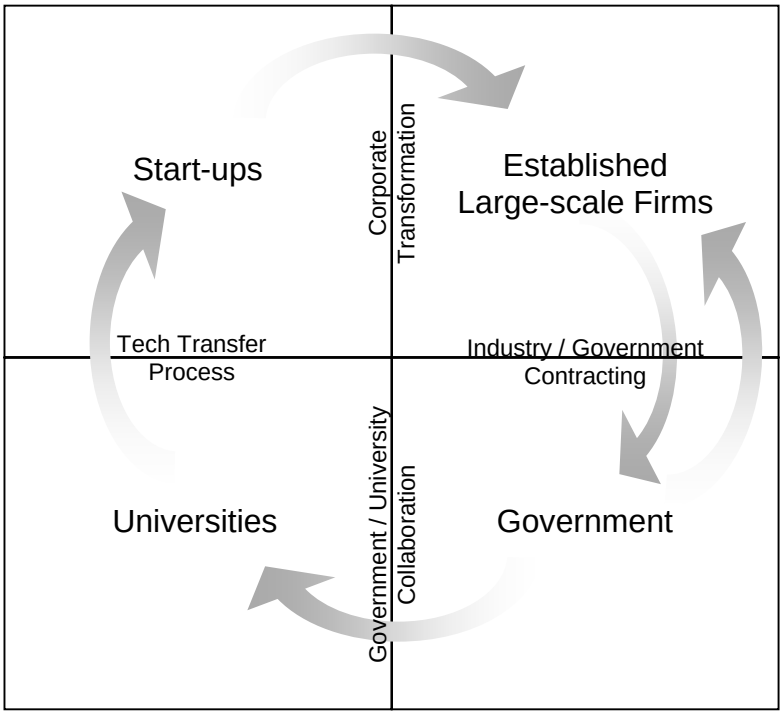
Moreover, we also understand the role of information technology in the productivity acceleration of the last ten years, as seen in the work of firms such as Microsoft and IBM. We intuitively recognize that the use of IT by, for example, UPS, Medtronic, and Wal-Mart, has changed the very structure of the American economy.

Yet it is here that economic research also highlights the limits of our knowledge, partly as a function of gaps in data collection and measurement. In particular, what features of the economy and sub-level indicators drive total factor productivity? Can we measure the genesis of innovation and its diffusion? Professor Jorgenson's newly issued report, *Enhancing Productivity Growth in the Information Age*, provides a welcome step in this direction, including several recommendations on measurement. Similarly, the Kauffman Foundation has supported work examining several corollary questions, such as: What laws, institutions, and structures stimulate innovation and how can we measure them?

An emerging hypothesis that I have advanced holds that specific firm features—age, size, and structure—matter a great deal for innovation. New and small firms evidently play a major role in driving innovation, as suggested in the diagram

below. Professor Will Baumol has written extensively on the symbiotic division of labor between large and small firms, finding that revolutionary breakthroughs primarily come from small entrepreneurial firms, while large firms specialize in scale contributions. Both, of course, are indispensable for growth and productivity, and one cannot exist without the other.

The Entrepreneurial Ecosystem



Source: Carl J. Schramm, "Building Entrepreneurial Economies," Foreign Affairs, July/August 2004, at 104.

Incomplete data hinder our understanding of this symbiosis, however. Kauffman has been working with the Census Bureau on developing a longitudinal database of firm-level data, as many European governments do. And, the Kauffman Firm Survey is a four-year series of 5,000 new businesses, weighted toward high-tech, that seeks to learn more about firm creation and growth.

Many companies and industries collect their own data and use their own metrics for tracking innovation, and it seems likely that government agencies can learn from these. For example, much of the extant research on the relationship between aggregate innovation and firm-level dynamics has been done in the manufacturing sector because of the extensive data available. We know, however, that service companies now account for an enormous share of the economy and also engage in a great deal of innovation. This is highlighted by the new National Bureau of Asian Research paper on developing service sector metrics, “The Measure of a Nation.” Further, IBM is instigating an entirely new discipline, namely, Services Science.

Our inchoate understanding of innovation in the largest part of the American economy stems directly from limited data collection and measurement, especially at the level of individual firms. To be sure, some promising steps are being taken to fill the gaps that currently exist. The Commerce Department’s Bureau of Economic Analysis has recently begun to improve its measurement of the services sector, as has the National Science Foundation. Likewise, the Census Bureau has begun assembling the Integrated Longitudinal Business Database to better track young and small businesses. But it is nevertheless clear to all of us that much work remains to be done.

While we may quickly agree on how to measure innovation in the economy as a whole—through total factor productivity, as persuasively demonstrated by Professor Jorgenson—I suspect that it will take more work and thought to figure out what intermediate measures of contributions to TFP we ought to gauge. This could include both positive measures (patents, licenses, research and development spending, number of new high-growth firms) as well as negative ones (cost of patents production, wasted R&D expenditures).

The central question we must answer in the months ahead, then, to conclude where I began, is this: Can we devise metrics that adequately capture the nature of innovation and the structure of the U.S. economy so that we may encourage continued progress and prosperity? I believe that we can and I look forward to our working together to accomplish this important objective.